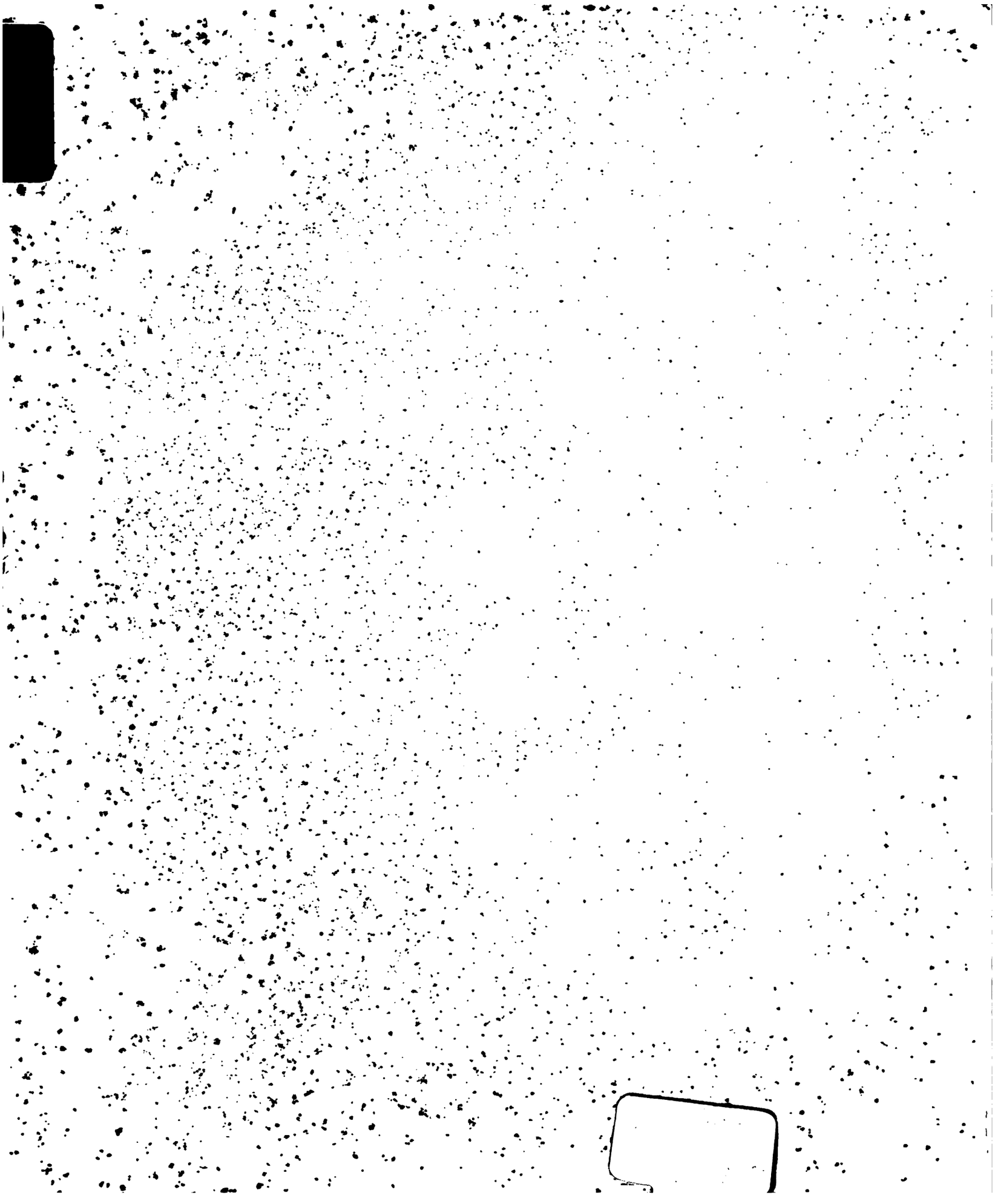

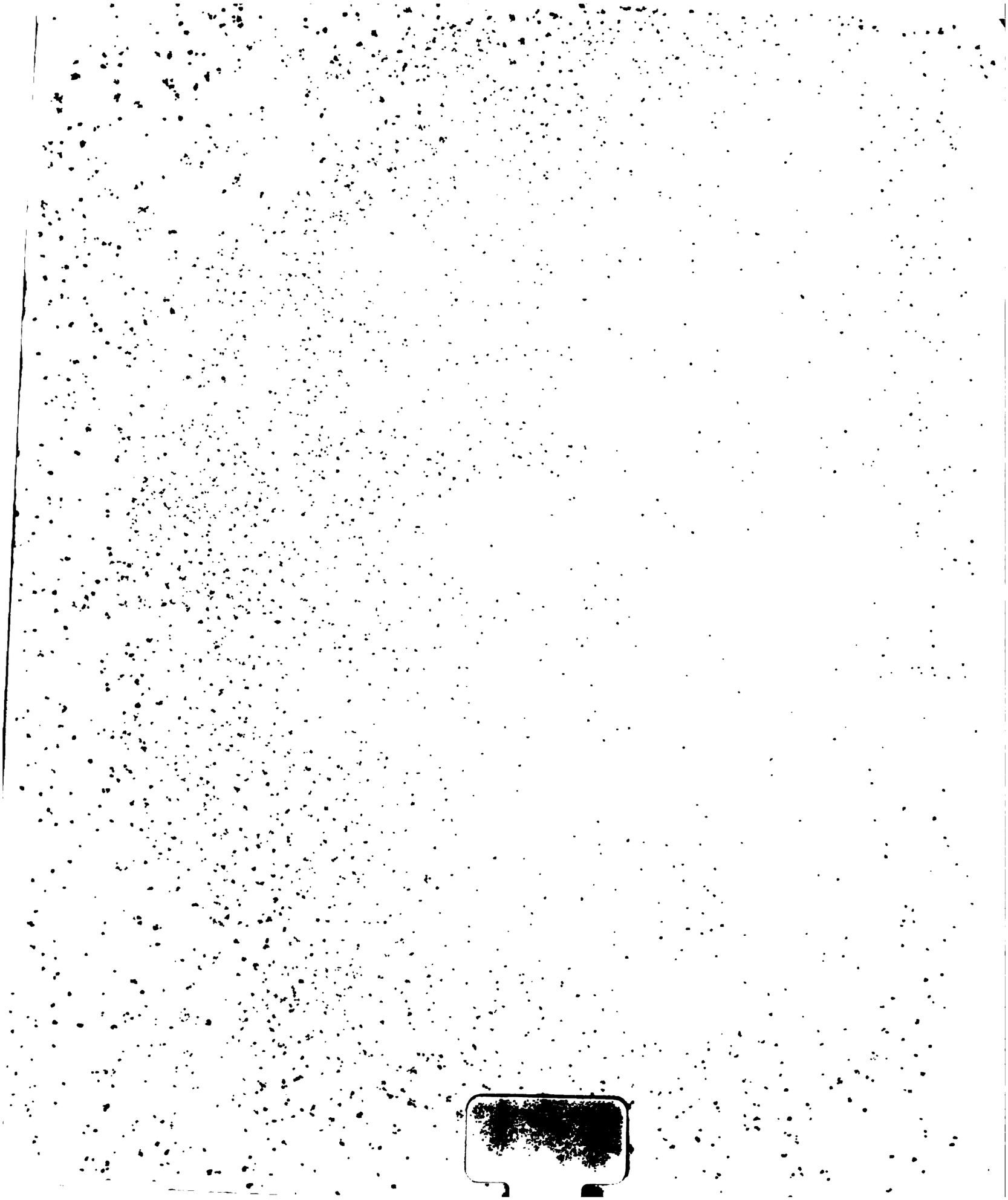

ON

EUPLECTELLA ASPERGILLUM.

ALSO ON

A NEW FORM OF GLOBIGERINA; PHOSPHORESCENT ANIMALCULES; SEA-SAWDUST; NEW FORMS OF FORAMINIFERA AND POLYCYSTINA.

BY

WILLIAM CHIMMO, CAPTAIN R.N.,

FELLOW OF THE LINNEAN SOCIETY, OF THE ROYAL GEOGRAPHICAL, ASTRONOMICAL, AND METEOROLOGICAL SOCIETIES OF LONDON.

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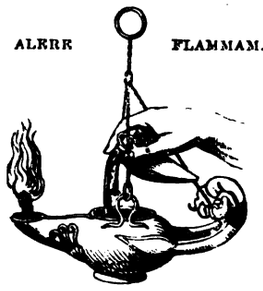

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EUPLECTELLA ASPERGILLUM

("VENUS'S FLOWER-BASKET").

REGADÉRA (*Spanish*), Watering-pot.

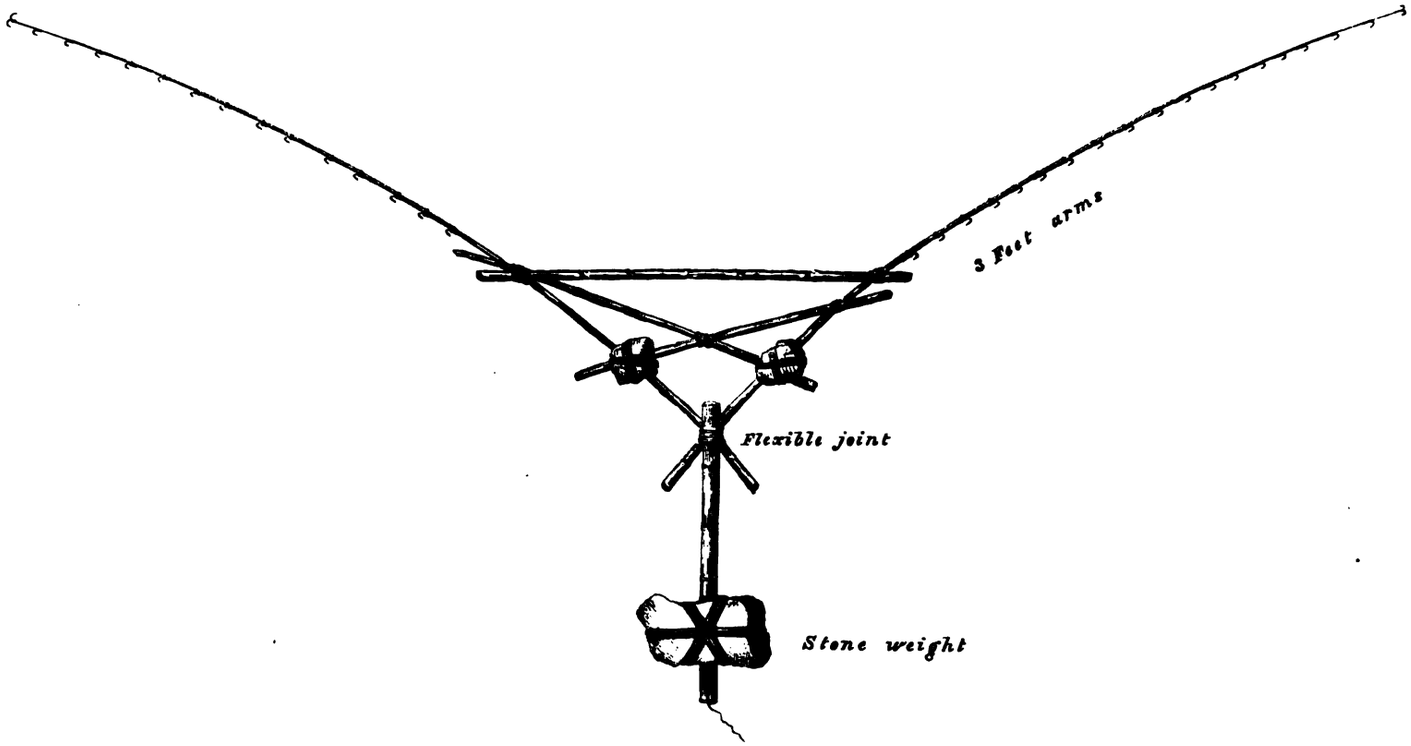
THE only spot in the world (as yet known) which produces that delicate and exquisite sponge *Euplectella aspergillum* is about six miles south of Zebu (one of the Philippine Islands), off a point called Talisay; the depth is great—120 to 140 fathoms (=840 feet); and this is the only place where this beautiful sponge is found by the native Bisayas, who fish for it during strong currents and smooth water with an ingenious trap formed, in the shape of the letter **Y** (see woodcut, p. 4), of two long slender and four shorter bamboos, lashed together and loaded with a big stone, and dragged along over the bottom like a dredge, having numerous fish-hooks fixed on the outside of the arms of the **Y** close together, which entangle and hook the Regadéra, tugging it up by the roots and very frequently wounding it, which may be seen in almost every specimen. They are then hung up to the branches of a tree to bleach in rain and sunshine; the spongy sarcode dies, dries, and falls off, leaving the white and exquisite skeleton or framework.

None but those on the spot, and who actually see this beautiful sponge brought to the surface, torn by the roots from its bed of soft dark mud by the tiny hooks of the Bisaya's trap, can possibly form an idea of the mode of growth, the progression, and final decay of this fairy-like structure. They are called by the natives, who first found them, the "Regadéra" (watering-pot); they grow on a bank, or rather in a hole of very dark mud, which contains many growing upright like a plant, although some have been taken which have fallen down from accident or natural decay; the frame then becomes blackened and discoloured from lying on the mud.

The Euplectellas are of various forms, but most generally partake of that of a cornucopia—about 12 inches in length and 2 inches in diameter at the top,

tapering to the root. Some few (three or four) have been found 2 feet in length, but these are very rare (Plate III.); others are double, two springing from the same root (Plate II.); others have a smaller one, and even two, sprouting or shooting from the same root (Plate III. fig. 3). Some have been found only an inch in length (Plate III. fig. 4); and another species has been found (Plate III. fig. 1) in the shape of a cucumber.

On being brought to the surface they are rigid, tough, and flexible; but when dry are rather brittle, but still retain much strength. Many specimens



Trap used by the natives for catching the Regadéra.

have been injured by some accidental cause; but their structure is then renewed, showing an awkward and unsymmetrical form.

Only three specimens of 2 feet in length have been as yet found; these are very beautiful, and sold for £4 each. The first pair of Euplectellas (found a few years since) sold for $50, the second $15, and finally $5 a pair; they are now cheap and abundant in their bleached state*. Live specimens are not

* Since writing this (four years ago) the bed is becoming exhausted.

easily procured; the natives cannot understand why they are preferred to the clean ones. They play many pranks with them, mending wounded parts, putting in parasites which never belonged to them, but which the natives consider necessary, "as they patch them up," putting on false roots, and many other dodges, which must always be looked for when purchasing them. The natives have a great aversion to showing you the place where the Euplectellas are dredged, or going with you, or in any way assisting to procure them, fearing that your motive is to deprive them of this means of livelihood.

About nineteen specimens out of twenty brought to the surface contain one or more parasites—Crustacea of at least four species (as will be seen in Plate V.). The parasite is supposed to enter the frame of the sponge while young or as spawn, and before the roof is crowned over, taking up its abode and becoming a prisoner for life. It was at first supposed, and is by some still believed, that this creature assists in the structure of the *Euplectella*; persons who have bleached specimens are careful to show you the "insect that produced the framework." The natives also believe it, and take care never to bring you one without it. It is needless to add that the crustacean has nothing whatever to do with it, further than finding it a safe and convenient dwelling, enters it, and there remains; it is simply to the *Euplectella* what the hermit crab is to its shell—a convenient dwelling, ready made!

I have stated before the difficulty, and, indeed, almost impossibility, of getting a native to go with you or show you where or how to obtain a live specimen; and it was not until I obtained an order from the Governor of Zebu, who said he would also accompany me, that I was able to get a man from Talisay Point to show me the spot. I dredged and toiled from seven in the morning till five in the evening, with all the conveniences and appliances of a steam-cutter, dredges, and even the traps used by the natives themselves. I had three of the best men from Talisay. One said, "there was too much wind;" another, "the current was insufficient;" a third, that "the line was too large." Perhaps they were all correct; but I was not repaid by a single specimen, and I returned to my ship thoroughly disheartened and disappointed.

Next day I passed over the spot in the ship, put over a trap I had made on board, and succeeded in taking two imperfect specimens and three smaller ones about an inch in length. I learned from this, however, two facts—that the structure is always closed at the top, and that its origin is a bud or shoot,

or gemmule. We were now prevented from further toil by the sudden death of one of our petty officers, and had to return to Zebu to bury him.

* * * * * * * * *

On passing over the same ground next day a canoe hailed us, and a native, holding up something in his hand, shouted out "*Regadéra* !" He came alongside; and I was well repaid for all my trouble by getting a magnificent perfect specimen (Plate I.) just hauled up from 110 fathoms, embraced in the arms of three splendid starfish (*Comatula rosacea*), one orange-yellow, the others deep Indian red. The arms of the starfish, ten in number, were 7 inches in length and branched, with numerous shorter ones about half an inch long, hugging and taking special care of their prize.

Having had a perfect specimen (alive) of the *Euplectella* before me, I will endeavour, as well as I am able, to give some account of it. I first placed it in salt water; but there was nothing to be gained from this except seeing the starfish hug more closely their companion, and to see the little parasitic Crustacea darting about in their prison. I then dropped all into some spirit; the starfish lost their brilliancy, and tinted the whole vase a beautiful amber-colour, light on top, darker at the bottom.

This specimen was 11½ inches in length by 2½ in diameter at the top, in the form of a cornucopia (Plate I.), the framework covered with a thick sarcode of brown spongy gelatinous material. The root was a mass of thickly matted spicules, barbed, about 2 inches in diameter, and entangling together mud, shells, weed, and many other things.

The framework itself (Plate IV. fig. 1) consists of longitudinal or vertical ribs of siliceous hairs deposited together into glossy threads. These are crossed transversely or ribbed by bands at regular distances; these are again crossed and recrossed and matted together, causing the apertures to assume a hexagonal form. This frame is then diagonally crossed with irregularly spiral frills of interlacing fibres; these are again recrossed diagonally and irregularly, the whole forming a very strong framework of most beautiful and exquisite siliceous spicules.

The top of the *Euplectella* is crowned with a lacework of even whiter material, very much resembling ladies' tatty-work well washed. The apertures are of various forms, unlike those of the upright frame; they are oval, triangular, and irregular; and the masses of threads are denser and whiter than those of the frame.

Plate IV. fig. 1 shows the general construction of the whole frame—vertical ribs of siliceous threads packed together, crossed at right angles by similar ones, then intertwined by numerous smaller knotty ones binding the whole framework; the squares thus formed are $\frac{1}{10}$ of an inch square, but the smaller ones reduce the figure to a hexagonal form.

Plate IV. fig. 2 shows the arrangement of the frill which crosses these squares diagonally; the frill is $\frac{2}{10}$ to $\frac{3}{10}$ of an inch wide; many of the parts contain rounded apertures or canals, and are wonderfully laced together.

Plate IV. fig. 3 shows the crown, which is denser and whiter than the frame, formed in irregular figures. It is still somewhat doubtful whether this is closed in when the *Euplectella* arrives at its full growth, or continues growing with it. I have dredged one only 4 inches in length with the crown perfectly formed; but I have also taken three scarcely an inch in length which have small rounded apertures, and the process of netting or crowning over had not commenced. If the former is the case it is not difficult to account for the Crustacea entering at their full growth (some more than an inch in length); but I have taken five Crustacea out of one form without an aperture of any sort to admit them, except as spawn or when very young.

Plate IV. fig. 4 is a portion of the root, which is thickly matted together, and is wonderfully provided for holding and firmly fixing in the mud, to prevent being washed away by currents or other accidental causes, by having each fibre thickly barbed, which does not happen in those fibres of the upright column; when these barbs get into the fingers they cause an irritating pain, and cannot be easily taken out. These roots are 2 to 3 inches in diameter, and entangle numerous ocean shells, Foraminifera, &c.

Among the former were found :—

Hyalæa, three species.
Cornucopia.
Pecten.
Dentalia.
Spirillini.
Creseis aciculata.
Cuviera columella.

Among the latter were :—

Globigerina of many sorts.
Spiroloculina.
Spirillinæ.
Cristellaria; very perfect.
Astrommæ.
Dentalinæ; perfect.
Textularia.
Polymorphina.
Biloculina.
Bivalves; minute.

There were also a beautifully fluted univalve (red), sponge-spicules of various forms, univalves, bivalves, and thousands of other new and interesting forms, which it would take more power and time to describe than I possess *.

The parasites (Plate V. fig. 1) (Crustacea) † found in the *Euplectella* are of four species; the most common is that resembling the sand-hopper (*Talitrus saltator*) or shrimp (*Gammarus pulex*). They possess a delicate and beautiful arrangement for swimming, situated behind the legs; there are three long legs on each side, and three shorter ones; two long antennæ situated on either side of the eyes, which are seated directly on the carapace, and are, or appear to be, a beautiful arrangement of black network. This parasite is of a pale cream-colour, and is very averse to leaving its home, requiring the utmost coaxing and pushing to get it out of its apparently luxurious and delicate bower; it is about $1\frac{1}{4}$ inch in length.

Another species (Plate V. fig. 2) resembles a small shrimp or lobster, having claws of equal size on each side and long antennæ; the carapace is dark brown; tail and claws pale yellow. I took *five* Crustacea of different species (except one) out of one framework which had no opening whatever!

The third (Plate V. fig. 3) is a species of the Alpheidæ, having one large claw; it is about $1\frac{1}{4}$ inch in length, of a deep red colour, and full of spawn. It most nearly resembles the *Alpheus brevirostratus*. While in the hand it made a sharp crackling noise with the beaks of its claw; on dropping it into spirit it did the same, flinging off its claw in the most suicidal manner, similar to the arms of the *Ophiocoma*. The claw is on the *left* side.

The fourth (Plate V. fig. 4) is similar, but of smaller size, the colour of fig. 2, having but one large claw situated on the *right* side.

Inside the frame of the *Euplectella* were also found three small bivalves, about $\frac{1}{2}$ to $\frac{1}{4}$ of an inch in diameter, attaching themselves by a byssus to the framework.

To describe the sarcode is not easy (with an imperfect instrument of low power); but on a superficial examination it appeared a soft, slimy, gelatinous brown coating on the framework, and the siliceous spicules deposited about and in it appeared more pointed and perfect than those of a bleached specimen of which Plate IV. fig. 1 is a portion. These delicate pointed portions probably

* A few will be seen in Plate VI.

† A full description of these Crustacea has just been published in the Journal of the Linnean Society, Zoology, vol. xiii. p. 506, by E. J. Miers, F.L.S., to which the reader is referred.

fall away when undergoing the process of cleaning, which is done by hanging them to the branches of a tree in sun and rain alternately until bleached; and I must confess they look much handsomer when so treated.

The fibres or threads (which under the microscope appear simple translucent bars) are extremely tough and elastic, and require considerable force to tear them asunder, especially those forming the root or base; and nature has wonderfully adapted them for anchoring their frail bark in the soft mud, by placing (in every instance) the barbs upwards like those of an arrow.

In looking over the construction of the frame of a live specimen, many beautiful forms (spicules) will be seen, particularly those with four, five, and six rays, as seen in Plate V. figs. 5 & 6. Many *Cristellaria* and Foraminifera will be found embedded in the sarcode, and many of the branches or threads are knotted and tubular, and interlaced in wonderful order and profusion, as in Plate IV. fig. 7.

The only question respecting the history of the *Euplectella* of which I have any doubt is how, and at what stage, the crustacean enters the framework. In a small specimen only 4 inches in length the top is crowned over the same as in a full-grown specimen. Again, in smaller ones of only an inch in length there is a round aperture; and on looking into one of these I saw a crustacean folded up, too large to move or escape through the top. It was apparently growing quicker and larger than its home: what the result would be cannot be told; but its cage, being very soft and flexible, may yield to the growth for a while of the occupant. If, then, the crown is formed at first growth or soon after, the parasite must enter either as spawn or when very young.

Plate IV. figs. 5 & 6 show the beautiful arrangement of the siliceous deposit, layer upon layer, and not in solid masses; the threads, when subjected to heat, resemble a telescopic slide.

The specimens from which the drawings &c. are taken were fished from a depth of 120 fathoms, living in dark soft mud and in a temperature of 81°, while the surface was 84°.

I will conclude with a few remarks on the spot where alone the *Euplectella* is to be obtained.

The place is very limited, perhaps not a quarter of a mile in area, at a depth of 120 to 140 fathoms. The marks for getting on the exact spot are:—1st, a red-tiled house (the Padre's) on Point Talisay, in line with a deep gap in the

highest hills (about east and west); 2nd, St. Nicholas Chapel, in line with a high peaked hill having three trees on it (north and south); and 3rd, about three miles off Point Talisay.

Note.—The true Regadéra (most probably *E. aspergillum*) will be seen in Plate III. fig. 2; by filling the mouth full of water, and blowing it through, it issues from the tubes at the top, exactly like a garden watering-can. Why this sponge should have been called by the same name by the Spaniards who found it I cannot tell, except that the crown of the *Euplectella* very much resembles that of a watering-pot.

The structure of the *Euplectella* (Plate IV. fig. 1), and the marvellous manner in which it is held together in its symmetrical form, requires an ingenious mode of description.

In fig. 1 it will be seen that the square meshes are arranged by four-rayed spicules placed at right angles to each other, and extending from one square to another, and continuing to several squares; these are again matted and interwoven by other spicules of various radiates, sexradiates, triradiates, and many other forms, twisted and bending themselves to suit the shape; many of these are spined and barbed (especially at the base) to lock together the mass of spicules. This mass is then coated over with a siliceous or vitreous solution of the same nature as the spicules, rendering the form extremely rigid. In the smaller forms, however (Plate III. figs. 3 & 4), all the spicules are visible under the microscope, and, it may be concluded, have not undergone that vitreous coating, nor will do so until arriving at a certain stage of development.

The corona (Plate IV. fig. 3), or open network at the head of the *Euplectella*, is composed of the same spicules woven together, and coated more densely with the vitreous solution, and is whiter in appearance, and is hard, dense, and rigid.

The frills or ridges are from $\frac{2}{10}$ to $\frac{3}{10}$ of an inch wide, and support the whole mass by embracing them in a very peculiar manner, the structure partaking of the corona and upright form combined: spicules lie along the skeleton, and throw out an arm to the ridge; these again intercept other delicate spicules, and are interlaced one with the other, and fused over with the siliceous coating.

The base or root is composed of long slender spicules, like spun glass, barbed at the lower part, and running for some length up the perpendicular fibres of

the skeleton placed exteriorly. The barbed portion is no doubt intended for holding them firmly in the mud, to prevent currents and other accidental causes dragging them from their place of birth.

Composing the whole mass of this curious and delicately constructed form are to be found spicules of many and various forms, sexradiate and lesser radiates, flesh-spicules, rosettes, spicules at right angles, acute and obtuse angles; others spined or barbed, others bent and curved to follow the course and direction of the structure, and numerous others, all assisting to build up and construct the beautiful and basket-like frame of the *Euplectella*.

Plate IV. fig. 6 illustrates the construction of each fibre, showing that the siliceous coating has been deposited in coils or layers. By subjecting the fibre to heat, each layer chipped off; and it may be concluded that, as the structure grows, so it is cemented or coated over, and obtains that rigidity which is always found to increase from the base, and to be perfect at maturity.

In the small specimens seen on Plate III. figs. 3 & 4, no coating of siliceous deposit was perceptible. These, in their primary state, were soft and flexible; and time had to add to them their rigidity and beauty, and symmetrical form, even to maturity; but what that time may have been we are still ignorant —whether hundreds of years passed away before the soft tiny *Euplectella* of 2 inches stature arrived at the beautiful structure of such original design, whose beauty cannot be added to nor taken from, and which presents so wonderful and so exquisite a sponge, forming a lacework of siliceous patterns and beauty, appropriately called "Venus's Flower-Basket!"

Note.—Since the foregoing was written, a specimen of so-called *Euplectella* has been dredged by the 'Challenger' off Cape St. Vincent. From the very meagre description given of it in 'Good Words' for July 1873, I should not conclude that it was identical with the Philippine species. I have not seen a drawing of it, nor an account of its size, shape, nor the temperature in which it was found at the bottom.

The various and varied forms of spicules forming this species mentioned by the finder of it may all coincide with those of the Zebu one; but the fact of their not being in any case fused or cemented together so as to form a rigid mass, may be considered conclusive that they are not identical with those of the Philippine Islands, but a distinct species.

ON A NEW FORM OF GLOBIGERINA

(ELONGATED OR RADIATED),

FOUND AT THE DEPTH OF 11,280 FEET IN THE SULU SEA.

ANY additions or contributions to the history of the *Globigerinæ*, or wonderful little chalk-makers, is so novel and so full of interest, that new or varied forms always attract much attention.

When sounding the Atlantic for the first cable in 1857, mud or ooze was brought up from a depth of 2000 fathoms; and it was not until it was placed under a powerful microscope that Professor Huxley discovered the little chalk-makers in dense profusion and in great variety.

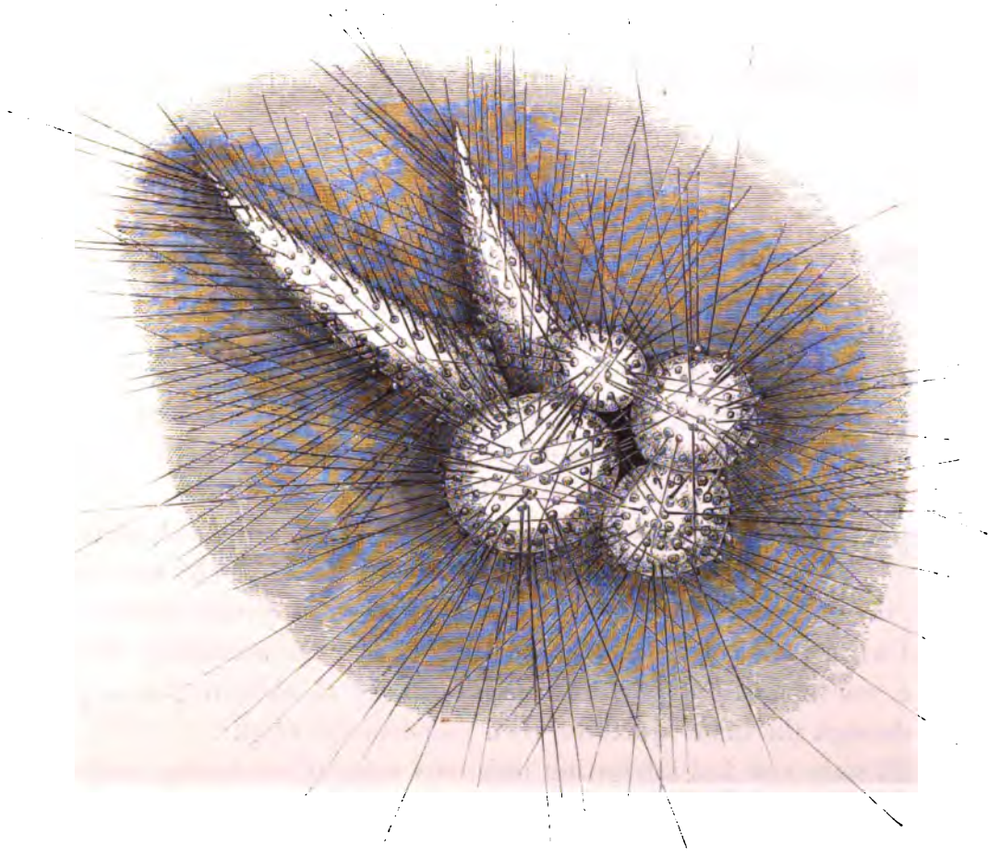
Later still it was found, first, that under immense pressure, and, secondly, by upheaval, these creatures formed the chalk cliffs of England; and again, later still, they were found living—existing during life in certain strata of the ocean, and when dead falling to the bottom. Their little chambers, invisible to the eye, encompassed a jelly-like mass, capable of extending to a great distance, through the small apertures, their pseudopodial arms.

Later still some new and interesting additions were added during the investigations of the Gulf-stream and deep soundings therein, and published in the 'Bed of the Atlantic,' 1870, by the author.

Again, the cruise of the 'Challenger' added more to our knowledge of the habits of this minute creature; and, lastly, during the voyage of the 'Nassau' the interesting specimen which is the subject of this paper was dredged from a depth of 1800 fathoms in the Sulu Sea.

These shells or chambers are entirely calcareous, formed of lime collected from the ocean. It is conjectured that the little jelly-like mass, when too large for the first chamber, commences to build another one, and so on to the number of thirteen chambers, when it is supposed to be at maturity, swimming about in the ocean, and when dead falling to the bottom, where, under a

pressure of two tons and a quarter to the square inch, it becomes solid chalk. The interior of these chambers is filled with a fine yellowish granular sarcode, having the appearance of very fine sand, the larger chambers having irregular patches of the same material coated here and there.



Globigerina (new form).
Invisible to the naked eye. Highly magnified.

The pseudopodial radiating arms are here added in this sketch to show the manner in which they exude from the shell, gradually and slowly; but on receiving any sudden shock they are retracted instantaneously, leaving nothing but the bright silvery coating of the minute apertures or pores.

There is much difficulty in ascertaining the direction in which the sarcode radiates from the shell, especially in the elongated chambers, as it is of so

delicate and flexible a nature that even the weight of the shell distorts it; but it may be presumed that it radiates direct from the centre through the pores, and further that these spines are probably hollow.

The radiating arms are evidently for one of two purposes, or both—either to create circulation around for the purpose of obtaining food, or for collecting lime for the formation of new chambers. The first of these which came under my microscope was in 1866, in a specimen brought up from 1680 fathoms in the Gulf-stream, where there was a feeble effort to exude the pseudopodial arms, but quite sufficient to show the process and mechanism of this delicate arrangement.

The fractured shells of the *Globigerinæ*, which come up from great depths, are very beautiful, and show marginal walls of vertical crystal-like formation clear as water, the fractured cells containing minute granules. In the small convex portions beautiful illustrations of the radiating perforations or canals of the foramina may be seen both direct and diagonal. Some of these also show the horizontal layers of each wall added layer on to layer, the outer ones thickening, and the external layer becoming coated with tubercles, the interior ones being of an enamel transparent smoothness. The interior wall shows the formation to be a perpendicular transparent four-sided cell, while the exterior was perforated by narrow canals running perpendicular to the frame. With many experiments in water, it was found that not only are the *Globigerina*-shells of more density than the water, but that they sank with a rapidity truly wonderful.

A thin membranous lining in some of the cells of the *Globigerina* was noticed; but it is doubtful if this is the remains of the once living mass of sarcode. The rounded apertures are larger or smaller, according to age and size; they are generally seen in the last two chambers, the lips of which are smooth and rounded off, with a transparent glassy finish. It is probable that these minute and delicate creatures live at various depths in the ocean, held in suspension, swimming or otherwise moving, for which their numerous pseudopodial arms appear so well adapted.

In many of these chambers, when broken, the perforations for the foramina are very distinct, and the indentations through the tumuli easy seen; the newly or last-formed chamber is generally transparent and colourless, while those near the first-formed chamber, at the spire, are coated with a light brown deposit. All those forms found in high temperatures in the Gulf-stream &c.

are larger and more fully developed than those in colder waters; and this is characteristic of the whole type in all parts of the world. Some are of double the size. The aperture or orifice, which is carried from chamber to chamber, and which probably assists the sarcode-body to convey food or other material to the inner chambers, is plainly seen in the figure.

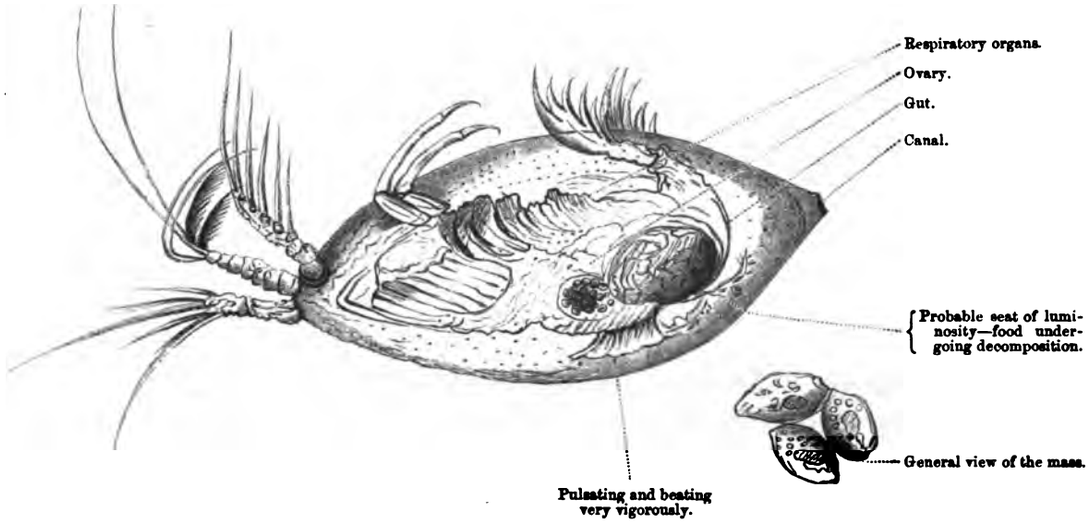
PHOSPHORESCENT ANIMALCULES.

Very little appears to be known respecting the cause of the luminous and phosphorescent appearance in the sea; it has been attributed to molluscous animalcules, to zoophytes, spawn of fish, decayed animal or vegetable matter. It is neither one nor the other, but a perfect independently organized crustacean, having respiratory, digestive, muscular, and generative organs highly and clearly developed. It is neither suggestive of storms nor other atmospheric phenomena; but is more frequently seen in calms, when probably it rises to the surface and takes advantage of tranquillity for feeding &c. But it is, like most other Medusæ, *Salpæ*, and other minute gelatinous and fragile creatures, seen more at spring-tides, full and change of the moon (like our common Medusæ on the sea-coasts), than at other periods.

Its appearance in the water is similar to that of the phosphorescent state of decomposing fish on a moonlight night—sometimes in masses, at others in single particles. The electrical state of the atmosphere is not in any way connected with it, for it is more commonly seen on clear cloudless nights than when the air is charged with electricity.

On one occasion, the sea being highly phosphorescent, the towing-net was put over, and caught many of these tiny creatures which throw such a blaze of light on the ocean. Under the glass they appeared like a small transparent egg-shaped sac, enclosing a minute crustacean form, having gut, ovary, muscular, and other highly organized systems. The outer sac, which contained fluid, was perforated throughout with minute ramifications, and at its extremity a canal, probably anal. The creatures darted and swam about in a variety of ways, sometimes in circles, at others direct; sometimes darting perpendicularly

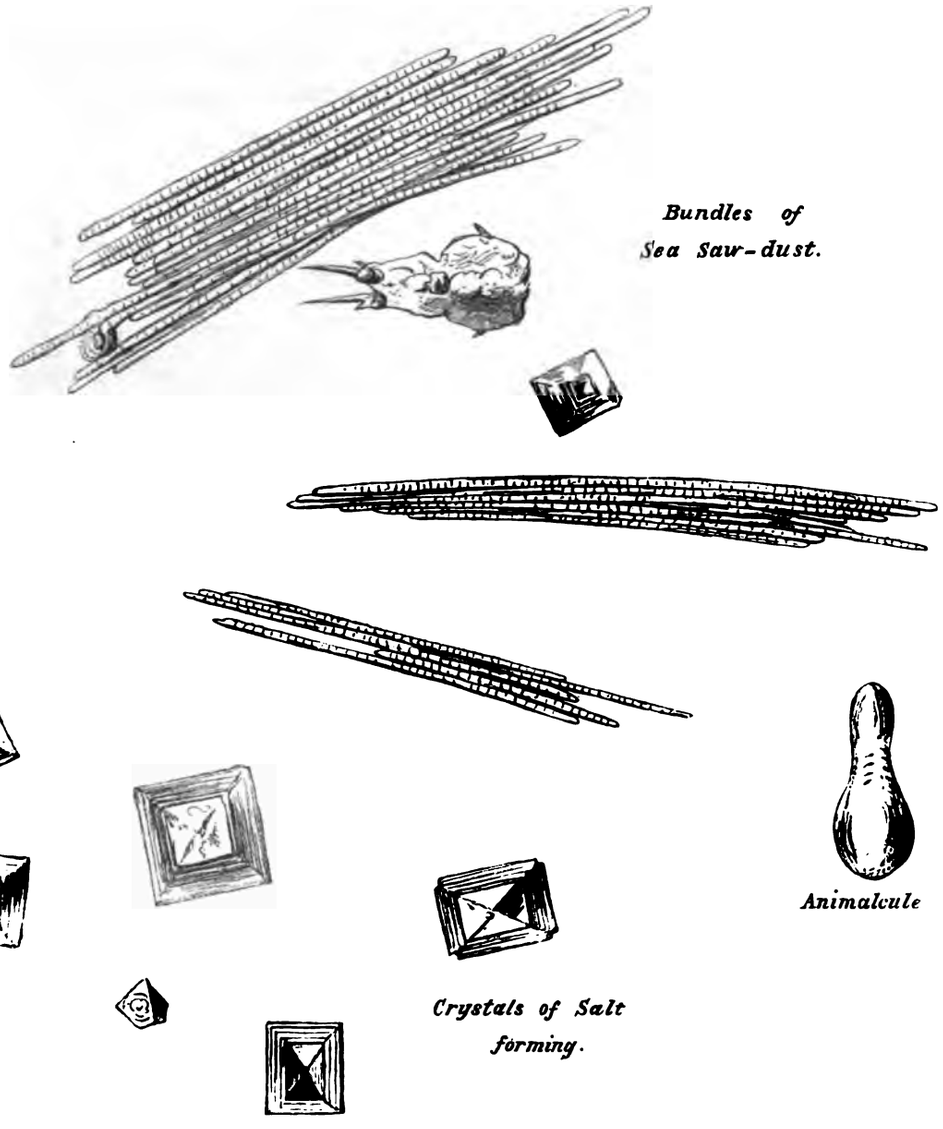
down the glass in which they were enclosed, and then gradually ascending to the surface. Under a low power they appeared, as in the sketch, in a mass of small sacs huddled together. Under a higher power the form was more clearly developed—the antennæ, ovary, gut, respiratory organs. The move-



Phosphorescent animalcule. Nat. size $\frac{1}{16}$ inch.

ment of the gills was very rapid; and the contents of the stomach, undergoing decomposition, were probably the seat of luminosity. The colour of these animalcules is generally of a bright blue, and, to the eye, they appear like small disks of glass.

SEA-SAWDUST.



Bundles of Sea Saw-dust.

Animalcule

Crystals of Salt forming.

THIS oily mass of animalcules, commonly called by sailors "Sea-sawdust," is found floating on the surface of the ocean in nearly all parts of the world, and

is the principal food of the whale, which may be seen in the arctic and antarctic waters skimming it off the surface, opening its huge mouth, and sucking it down in streams. Under a microscope of low power it has the appearance of small bundles of sticks tied together, having a few minute Crustacea and animalcules swimming among it. It covers the surface of the sea for miles in extent, and is generally of a red, yellow, or greyish tint. On being taken out of the water decomposition at once takes place; and in a short time the smell is very offensive, resembling that of a dead whale.

A few crystals of salt which formed under the microscope are shown in the woodcut, showing the immense amount of evaporation, eight degrees of which were measured by Daniel's ethereal hydrometer.

A BRIEF DESCRIPTION

OF SOME

NEW FORMS OF FORAMINIFERA AND POLYCYSTINA

FOUND AT

GREAT DEPTHS IN THE SULU SEA.

PLATE VI. fig. 2. A new and distinct form of Foraminifera, having four spherical chambers and two elongated ones, about twice the length, from 1880 fathoms.

Plate VI. fig. 19. This pretty form of Polycystina is cup-shaped. Four views are given (*a*, *b*, *c*, *d*):—*a*, side view; *b*, a quarter view; *c*, inside view; and *d*, a front view. The skeleton was glassy, and coated apparently with minute granules. Size about ·001 of an inch; the pittings were very distinct.

Plate VI. fig. 18. A beautiful form of *Cristellaria*; three views—front, side, and obverse.

Plate VI. fig. 20. *a*, a rare form of *Entosolenia marginata*: shell oval, with tubular neck, swelling midway; margin siliceous; radiating striæ from centre to margin; surface of upperside smooth and clear; underside minute granules of sand. *b*, orifice, enlarged; *c*, underside of centre; *d*, side view.

Plate VI. fig. 1. A rare and beautiful siliceous Polycystina from 40 fathoms, yellow mud of Borneo; lagena tubular, and orange-like liths.

A few interesting and probably new forms were collected from some mud obtained from the bottom of a crater 320 feet deep, on the island of Cagayan,

Sulu, north of Borneo. They are the first ever obtained from the depths of an extinct volcano. I had neither time nor a sufficiently powerful instrument to give any details of these very beautiful forms. The mud had a strong sulphurous smell when brought up. The sea flows over a shallow coral reef into this crater every tide; the temperature is 84°, and its density is 1·0222.

It will be seen that in some of these forms the base or cone is alone pitted by Foraminifera, the other chambers being entirely free (figs. 3, 8, &c.).

Plate VI. fig. 14 is a new form of Foraminifera—a monothalamous mass, pitted throughout, and of a dark brown colour. Some are beautifully marked, such as figs. 8, 11, and 13, and only require a powerful instrument to reveal their beauty.

The bivalves (figs. 5, 12, &c.) are very beautiful, of a pale delicate yellow colour; they are very numerous, and characteristic of the whole mass of mud brought up from the bottom.

There are several craters on this island; but the most remarkable one is on the south face, which is entered over a coral reef—through which a passage is formed in the narrow neck of cliff, consisting of thin layers of trap, sand, gravel, and stones, and communicates with the sea.

I visited this remarkable crater-lake in the midst of torrents of rain, thunder, and lightning; it is nearly circular, having a basin of deep dark blue water, 320 feet in depth. The cliffs around are densely clothed with trees, reflecting their dark shadows on its surface. It has a depth of 90 feet at the distance of a boat's oar from the rocky margin.

The bottom, at the centre, was soft yellow adhesive mud, with a strong sulphurous smell. This mud, when thoroughly washed and placed under the microscope, revealed the most marvellous field of minute microscopic beauty. It must be known to the wise only whether life exists there or not!

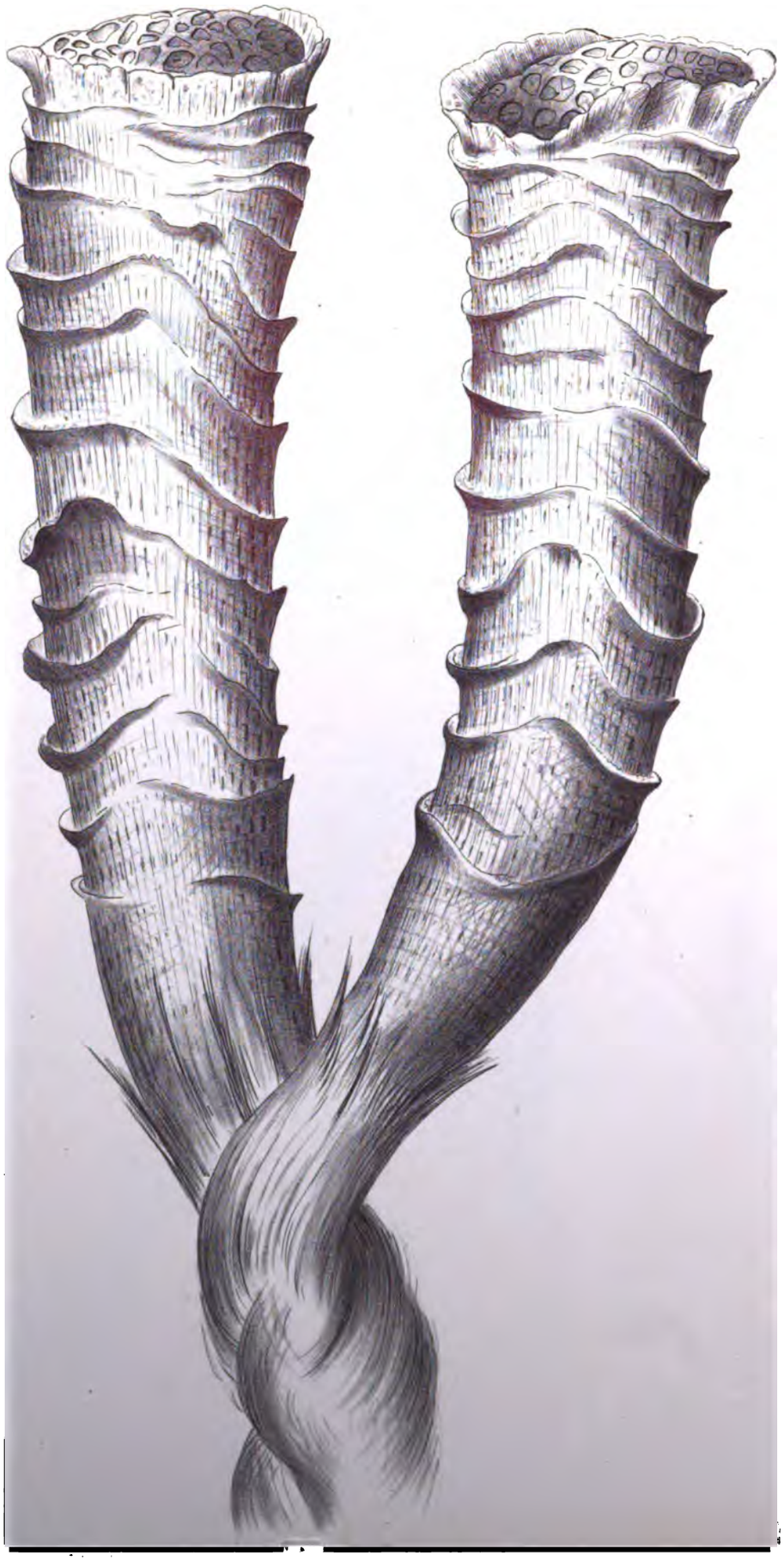
Several Foraminifera, Diatomaceæ, and sponge-spicules were seen; but the most numerous and characteristic were the beautiful little bivalves of varied tints and of many new forms.

I sent bottles of this mud to many of my friends in England, who will doubtless detect new and interesting forms; and we shall doubtless find that even from the depths of an extinct volcano creatures will be found which will elicit both our wonder and admiration.

W. Chimmo del. C. L. G. lith.

Minterm Bros imp

Euplectella Aspergillum.
dredged alive from 120fms off Zebu.
the original in the possession of the Author.



W.Chimmo del. C.L.G lith.

Mintern Bros imp

Double Form of Euplectella. on same root.

Fig. 1.

Fig. 2.

Fig. 4.

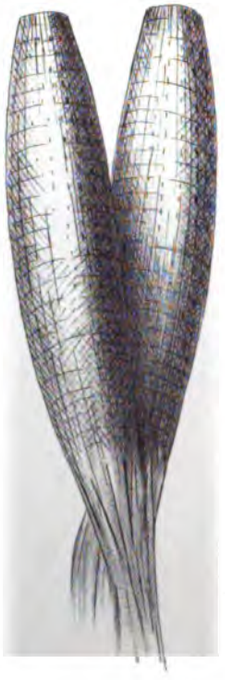


Fig. 3.

W. Chimmo del. C.L.G. lith.

Mintern Bros imp

Fig. 1. Euplectella (cucumer) very rare.
Fig. 2. True Regadéra (Spanish) probably Aspergillum.
Figs. 3. 4. Primary state of Euplectella. nat. size.

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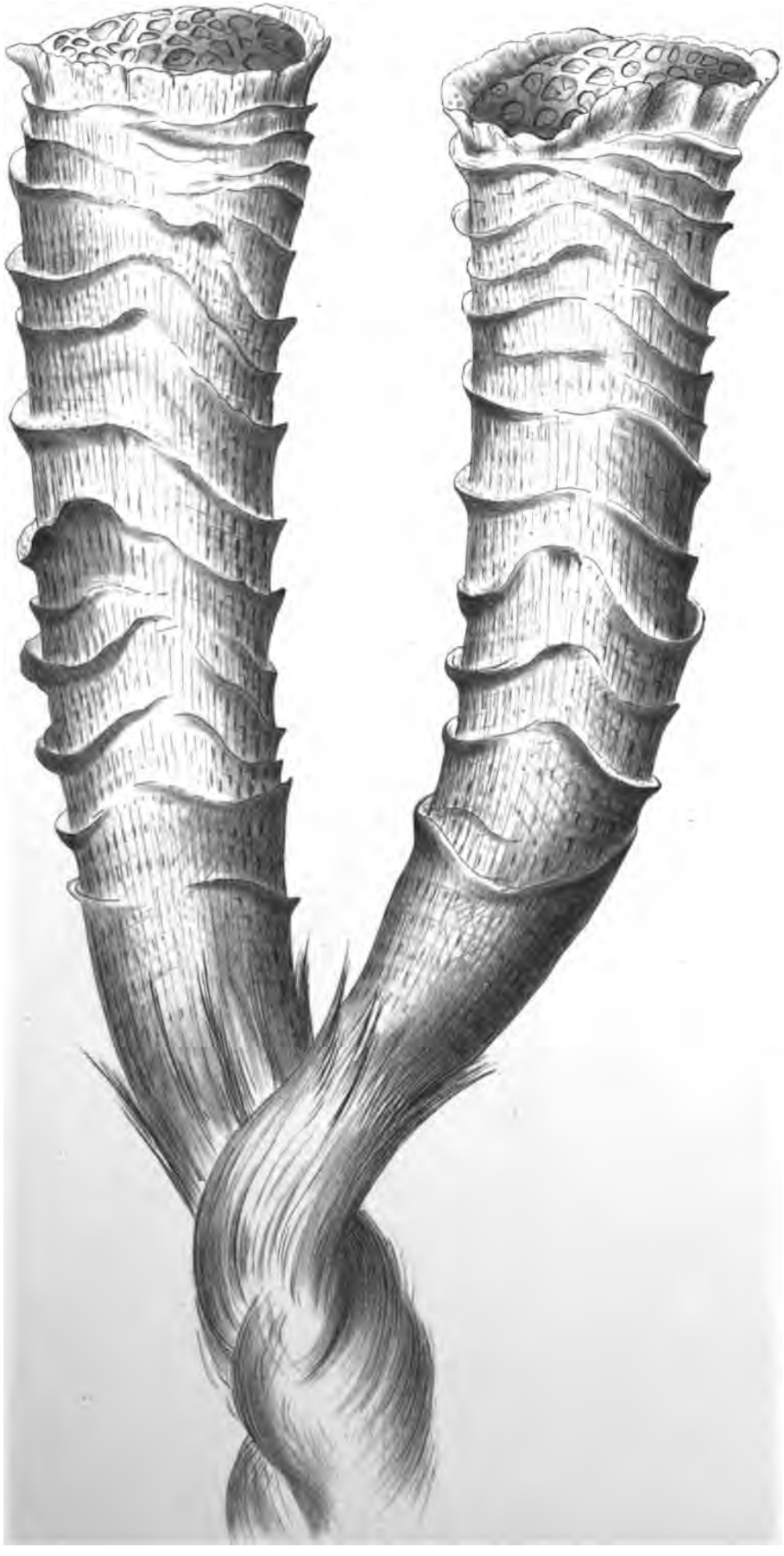

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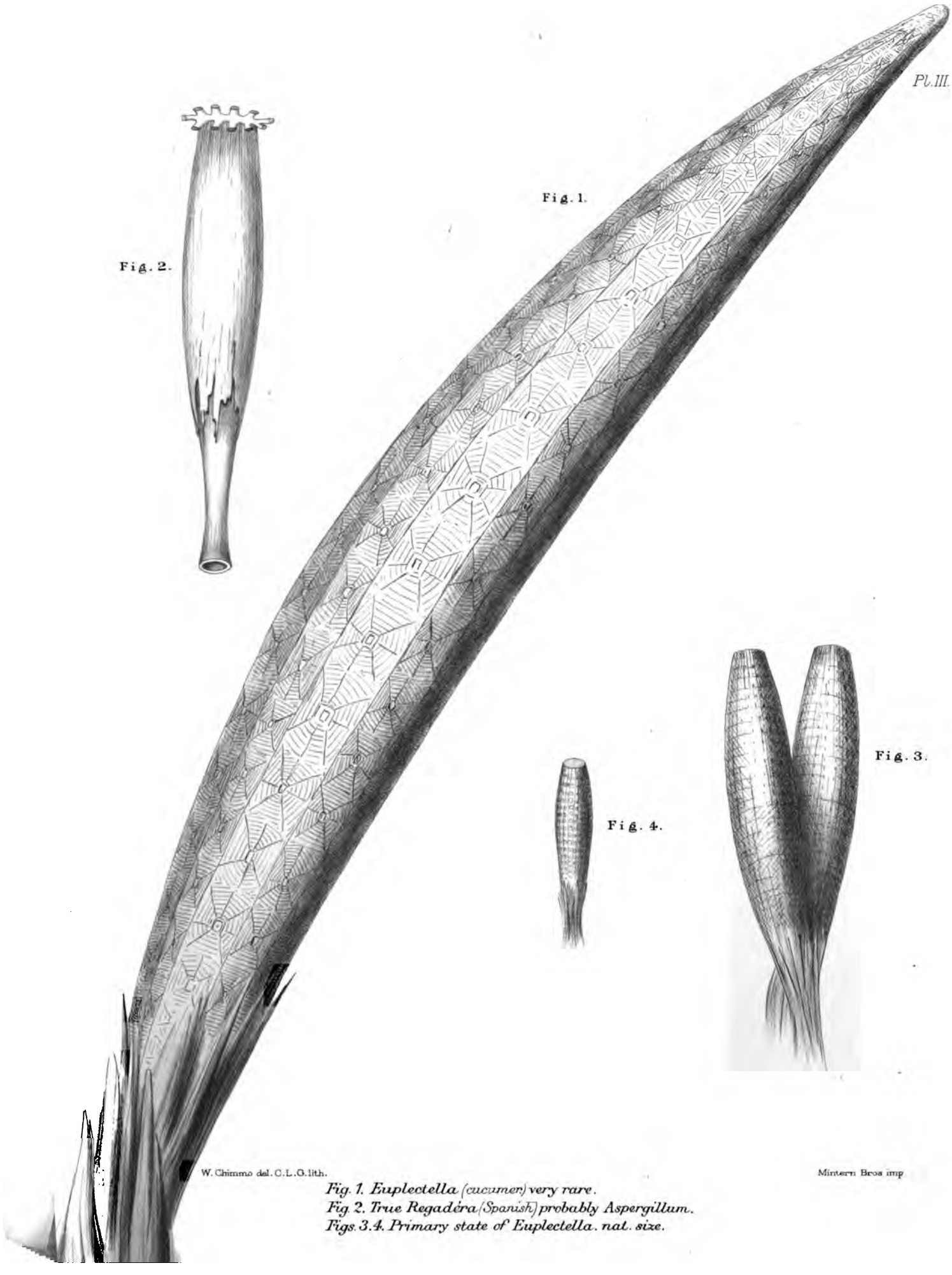

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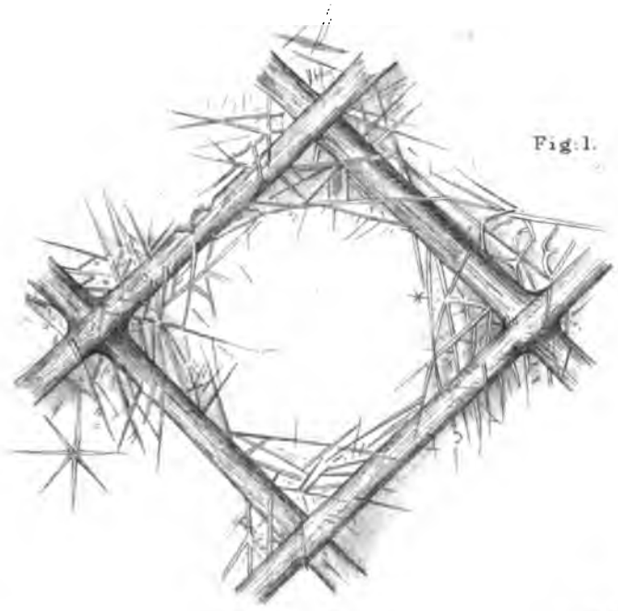
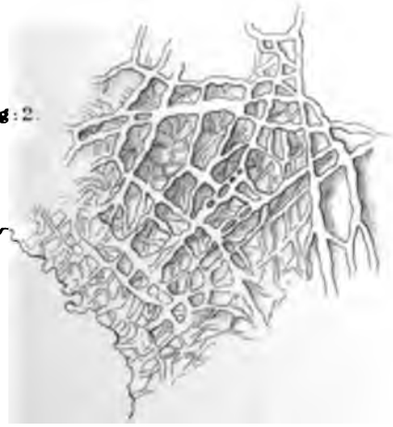


Fig: 1.

Fig: 3.

Fig: 2.



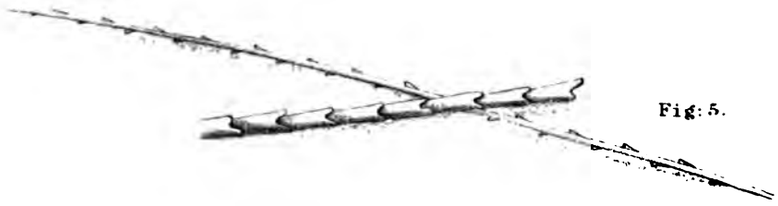
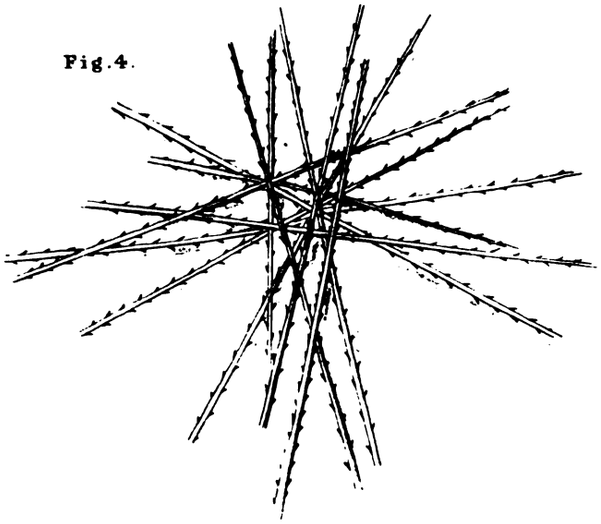


Fig: 5.

Fig. 4.



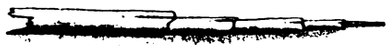


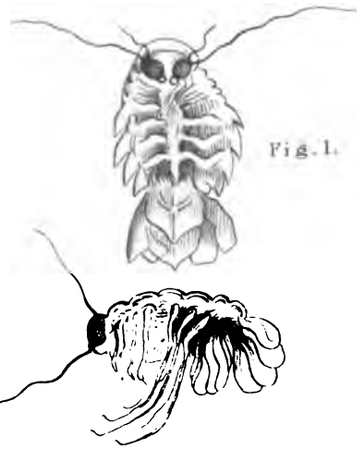
Fig: 6.

Fig: 7.

W Clemmo del. C.L. G lith.

Mintern Bros. imp.

General Structure of the Euplectella Aspergillum.
(Regadéra)



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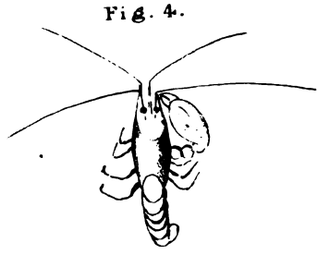


Fig. 5.

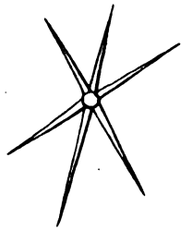
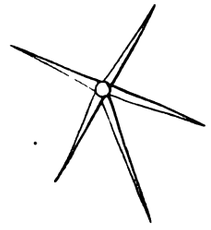


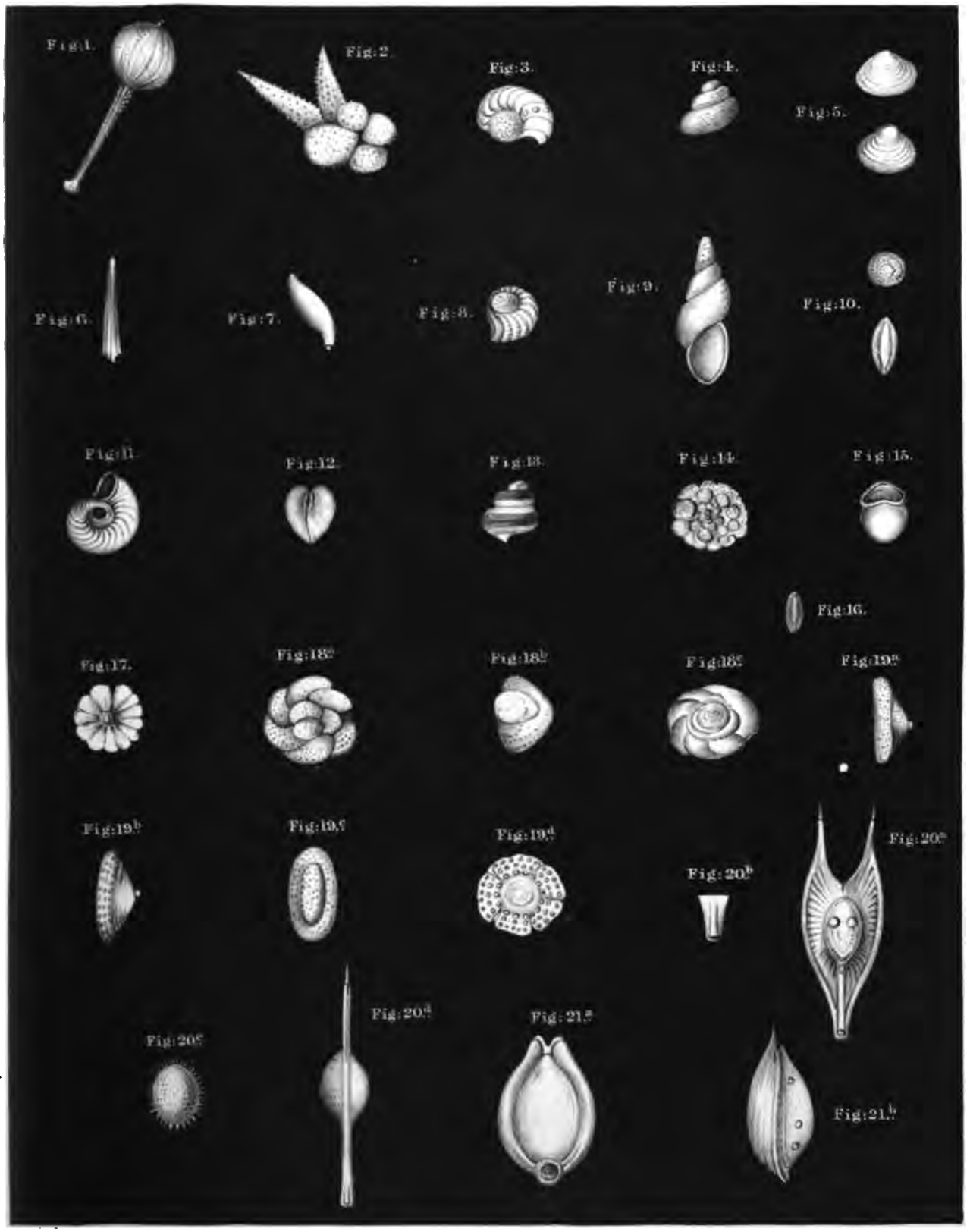
Fig. 6.



Mintern Bros imp.

W. Chesmore del. C.L.G. lith.

Parasites of the Euplectella.



W Chimmo del. C.L. G lith

Mintern Bros imp

New Forms of Foraminiferae etc. found at great depths in the Sulu Sea.

Fig. 1, New form of Polycistina 40 f^ms off Borneo, Fig: 2 New form of Globigerina from 1880 f^ms in the Sulu Sea. Fig 3 to 16 incl, Bivalves, Foraminiferae etc. from the Crater of Sulu, invisible to the naked eye, magnified 80 powers.